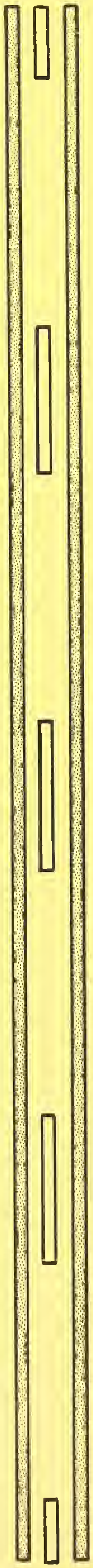
S
625.794
H3pm
1965

STATE DOCUMENTS

MONTANA STATE HIGHWAY COMMISSION

PAVEMENT MARKINGS



MONTANA PAVEMENT MARKINGS May 1, 1965

MAY 1, 1965

MONTANA STATE LIBRARY
930 East Lyndale Avenue
Helena, Montana 59601

426.3

Montana State Library
3 0864 1006 4875 0

STATE HIGHWAY DEPARTMENT
HELENA, MONTANA

May 27, 1965

MEMORANDUM

TO: DISTRICT & DIVISION ENGINEERS

FROM: PAUL M. JOHNSON, State Highway Engineer

SUBJECT: MANUAL ON "PAVEMENT MARKINGS"

The attached manual entitled "Pavement Markings" was prepared by the Traffic Engineer's Office in cooperation with the Maintenance Engineer. This manual replaces the manual issued in December, 1960. Copies of this 1960 manual and the handouts used in recent schools should be destroyed. All pavement markings accomplished by Montana Highway Department forces should conform as nearly as practicable to this manual.

Pavement markings are important traffic control and safety devices. If they are to be useful and meaningful to the public, pavement markings must be used properly and uniformly. This manual, together with the schools which were held recently for field maintenance personnel, are part of a continuing effort to improve and standardize our practices.

Additional copies of this manual are available from the Traffic Engineer's Office. Please refer questions, suggestions, or comments to the Traffic Engineer or the Maintenance Engineer.

Paul M Johnson
Paul M. Johnson

PMJ:el
Encls.

DISTRIBUTION

District Engineers - 4
Division Engineers - 5
Maintenance Engineer - 5
Safety Director - 3
Construction - 3
Road Plans - 2
Other Helena Depts. - 1

Digitized by the Internet Archive
in 2015

https://archive.org/details/pavementmarkings1965mont

426
c. 2

PAVEMENT MARKINGS

A

Supplement

To The

MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES FOR STREETS AND HIGHWAYS

As Prepared By

Traffic Engineers Department

Montana Highway Commission

STATE HIGHWAY COMMISSION

Helena, Montana
May 1, 1965

STANDARDS FOR PAVEMENT MARKINGS

I. INTRODUCTION:

In order to bring pavement markings on the entire State Highway System to a higher order of uniformity and to conform more closely with the "Manual on Uniform Traffic Control Devices", these standards are for the use of all who have the responsibility for providing pavement markings on the State's highways.

The standards shown herein are to be considered a supplement to the Uniform Manual, covering in more detail those pavement markings most frequently used throughout the State.

A. The following types of markings are covered:

1. Center lines. (Figures 1 & 2)
2. Lane lines. (Figures 1 & 2)
3. No-Passing barrier lines. (Figures 3 thru 6A)
4. Pavement edge lines. (Figures 1 & 2)
5. Transitions. (Figure 7)
6. Channelization. (Figures 8, 9, & 10)
7. Acceleration - deceleration lane markings. (Figure 11)
8. Layout symbols. (Figures 12 & 13)
9. Truck climbing lanes. (Figure 14)
10. School crossings. (Figures 15 & 16)
11. Railroad crossings. (Figure 17)
12. Word and symbol markings. (Figures 18 & 19)
13. Parking space limits. (Figure 20)

B. Reflectorization: All pavement markings shall be reflectorized by the use of glass beads, either pre-mixed or drop-on method, or a combination of both methods.

C. Colors: Pavement markings shall be either white or Highway yellow in color. Center lines, lane lines, and pavement edge lines shall be white in color. No-Passing barrier lines shall be yellow in color.

D. Size: Longitudinal pavement lines shall be 4 inches wide. Rural center lines and lane lines shall be 15 feet long with a 25-foot gap between segments. In urban areas, a 9-foot long line shall be used with a 15-foot skip.

E. Maintenance: All markings shall be kept in good order and clearly visible at all times. The frequency of re-striping will depend upon the type of surface, density of the traffic and the quality of the last striping.

II. PAVEMENT MARKINGS:

A. Center lines:

1. Rural two-lane - a broken white line, 4 inches wide, 15 feet long with a 25-foot gap between segments. (Figures 1 & 2)

2. Rural four or more lanes - two solid yellow lines, 4 inches wide separated by a space of not less than 4 inches. (Figures 1 & 2)

3. Urban two-lane - a two-way street shall have a solid white centerline, 4 inches or more wide. On a one-way street the centerline is a lane line and shall be a broken white line, 4 inches or more wide, 9 feet long with a 15 foot gap between segments. (Figures 1 & 2)

4. Urban four or more lanes - a two-way street with four or more lanes for moving traffic at all times shall be a double solid yellow line. (Figures 1 & 2)

B. Lane lines: Lane lines shall be used on multi-lane highways and streets.

1. Rural roads - lane lines shall be a broken white line, 4 inches wide, 15 feet long with a 25-foot gap between segments. (Figures 1 & 2)

2. Urban streets - lane lines shall be a broken white line, 4 inches wide, 9 feet long with a 15-foot gap between segments. (Figures 1 & 2)

3. High speed boulevards and controlled access highways in urban areas will be marked the same as rural highways.

C. No-Passing zones: No-passing zones shall be marked by a solid yellow barrier line placed as the right-hand element of a combination line along the center or lane line. The combination line shall consist of a normal broken white center or lane line continuing through the no-passing zone with the solid yellow barrier line placed to the right of it. (Figures 1 & 2)

D. Warrants for no-passing zones: No-passing zones are warranted when the sight distance ahead is less than that for safe passing at the speeds prevailing on the highway and in advance of those situations where passing is particularly hazardous, such as narrow bridges and certain intersections. Sight distance on a vertical curve is the distance at which an object 4 feet above the pavement can just be seen from another point 4 feet above the pavement, as illustrated in Figures 3 & 4. Similarly, sight distance on a horizontal curve is the distance measured along the center line between two points 4 feet above the pavement on a line tangent to the embankment or other obstruction that cuts off the view on the inside of the curve. (See Figure 5)

TABLE NO. I

85% Speed on Highway MPH	Highway characteristics that may be used to classify speed rating in lieu of determination of 85% speed.		Minimum Sight Distance
50	Pavement Width	22 feet or more	800 feet
	Horizontal Curve	Maximum 10°	
	Vertical Curve	Min. K Value = 85	
60	Pavement Width	24 feet	1,000 feet
	Horizontal Curve	Maximum 6°	
	Vertical Curve	Min. K Value = 160	
70	Pavement Width	28 feet or more	1,200 feet
	Horizontal Curve	Maximum 3°30'	
	Vertical Curve	Min. K Value = 255	

K value, as shown above, is a coefficient by which the algebraic difference in grade may be multiplied to determine the length in feet of the vertical curve which will provide minimum stopping sight distance.

It is suggested that each District Engineer prepare a map of the highways in his District and classify each section into the above 3 speed classifications.

The minimum length of a No-passing zone shall be 500 feet. If the actual No-passing distance is less than 500 feet in length, the additional length of marking shall be added at the beginning.

When the distance between the end of one No-passing zone and the beginning of the following No-passing zone is less than 600 feet, the zones shall be extended through the intervening distance. (See Figure 4)

When two paved highways intersect, the approaches to the intersection shall be striped as No-passing zones for a distance of 300 feet in urban areas and 500 feet in rural areas. (See Figure 6A)

When a bridge has a curb-to-curb width of less than 24 feet, a 500-foot No-passing zone shall be marked for each approach lane. (See Figure 6)

Truck-Climbing lanes shall be striped as shown in Figure 14. Truck-Climbing lanes should not be striped unless at least 36 feet of surfacing is available for use as a traveled way.

E. Pavement edge lines or shoulder lines: A solid white 4 inch edge line shall be used wherever there is a paved roadway surface of 24 feet or more. Divided multi-lane highways shall have the inside shoulder striped. Where the median is paved flush with the traffic lanes, the double barrier line shall be used in all cases. (See Figure 2)

F. Transitions: Pavement markings at transitions should be laid out very carefully. Uniformity is a must, due to the higher speeds encountered at the Interstate transitions and the increase in the number of such facilities. A number of situations are possible; however, two typical transitions are illustrated in Figure 7.

G. Channelization: The channelizing line shall be a solid white line, generally 8 to 12 inches in width. This type line has many uses but should, in all cases, be used with discretion. Figures 8, 9 and 10 illustrate some typical uses of this line; however, the Uniform Manual lists many other uses of the line.

H. Acceleration and deceleration lane markings: Geometric design sets rigid controls on acceleration and deceleration lane markings. Because the function of the facility depends so much on proper markings, it is imperative that each acceleration and deceleration lane is carefully laid out, using the road plans as a guide. Figure 11, illustrates the proper markings and their location. Figures 12 and 13, show the layout deceleration lane shoulder marking; a definite angle point must be evident to the approaching vehicle in order to distinguish the ramp exit from the main travel lane.

I. Truck climbing lanes: Truck climbing lanes are striped for no-passing throughout the length of the additional widening on the uphill lane. No-passing zones on the downhill lane are limited to those areas where the sight distance is less than shown on Table 1. The tapers used to introduce the additional lane should be delineated by the use of a shoulder or pavement edge stripe. Here again, care should be used in laying out the angle points in order to define the beginning and end of the widening. (See Figure 14)

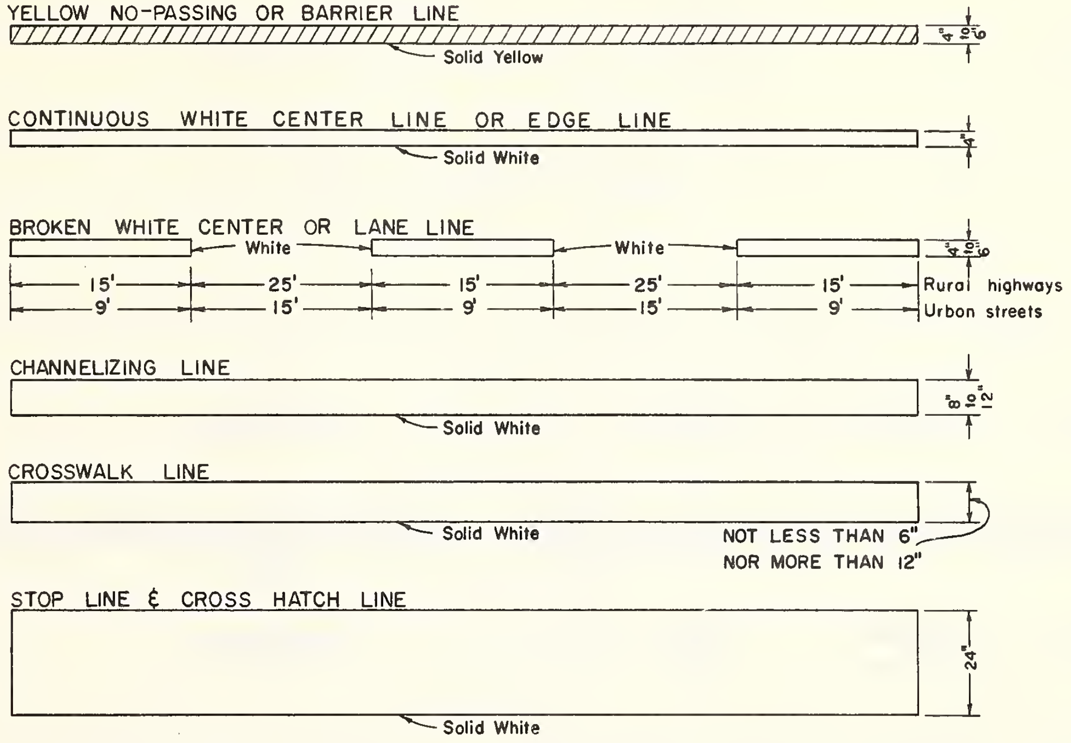
J. School crossings: School crossings should be marked as illustrated on Figures 15 and 16. The proper signs should be in place, if possible, at the time the pavement markings are laid down.

K. Railroad crossings: The pavement markings as illustrated by Figure 17, should be placed at all paved approaches to railroad crossings except at minor sidings in urban areas where other protection is afforded.

L. Word and symbol markings: These markings are not to be used for mandatory messages except in the support of standard signs. The markings are to be used on the apporach to an intersection to supplement Lane-Use-Control signs indicating the types of movement that are permitted from specific lanes. On one-way streets the straight-thru arrow may be used near intersections to indicate the proper direction of traffic flow. (See Figures 18 & 19)

M. Parking space limits: Although the Highway Department does not normally mark parking space, Figure 20 has been included to illustrate the normal limits of such zones. Parking limits in relation to intersections should conform to this standard in order to provide sufficient sight distance and minimize interference of vehicles parking and unparking.

LINE SPECIFICATIONS


YELLOW NO-PASSING OR BARRIER LINE
Solid Yellow
4" to 6"
CONTINUOUS WHITE CENTER LINE OR EDGE LINE
Solid White
4"
BROKEN WHITE CENTER OR LANE LINE
White
White
4" to 6"
15' 25' 15' 25' 15' Rural highways
9' 15' 9' 15' 9' Urban streets
CHANNELIZING LINE
Solid White
8" to 12"
CROSSWALK LINE
Solid White
NOT LESS THAN 6"
NOR MORE THAN 12"
STOP LINE & CROSS HATCH LINE
Solid White
24"

CENTER LINE COMBINATIONS

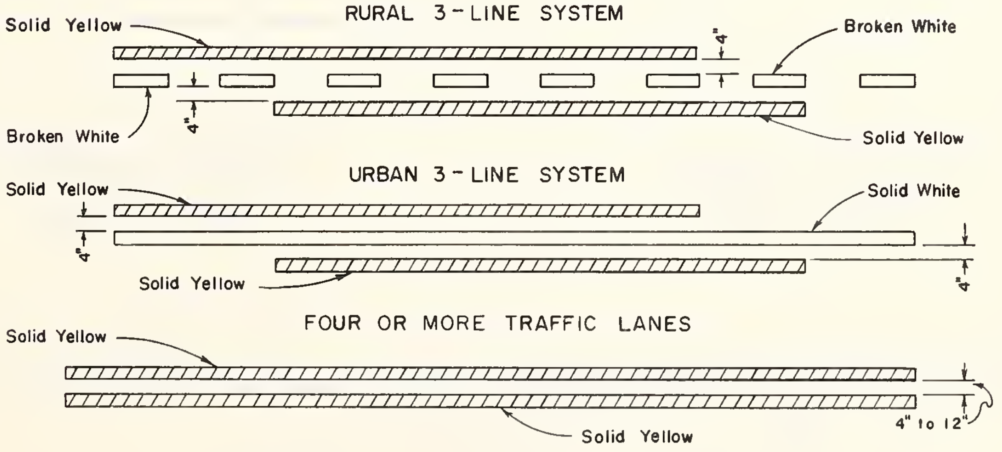
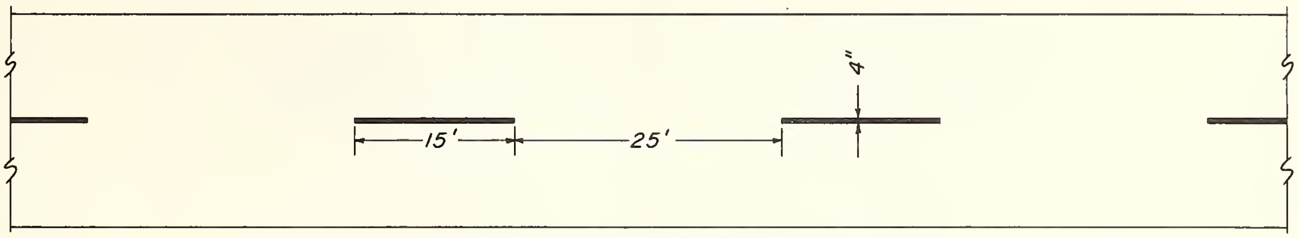
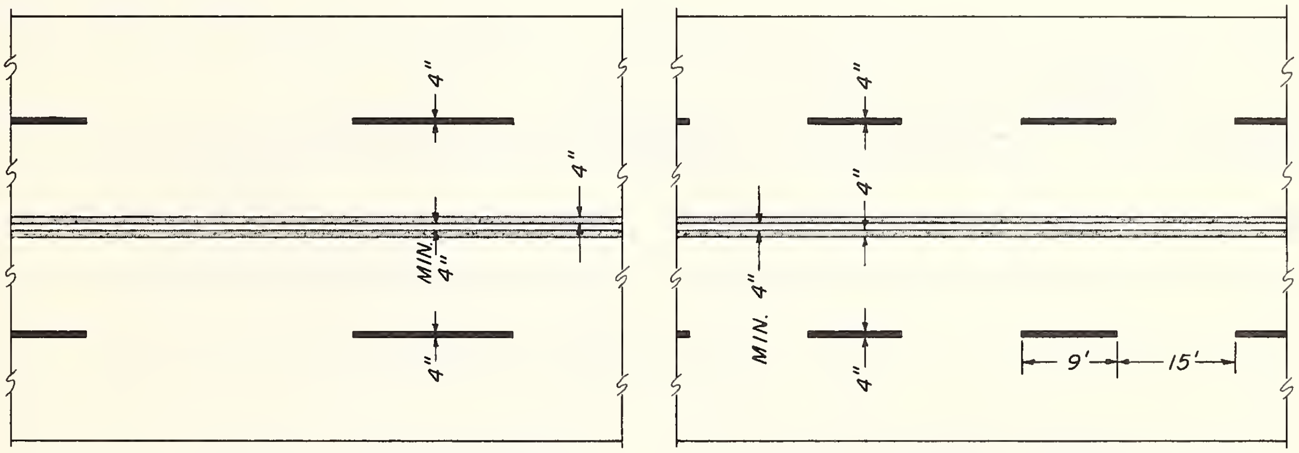


FIGURE 1

STANDARD PAVEMENT MARKINGS

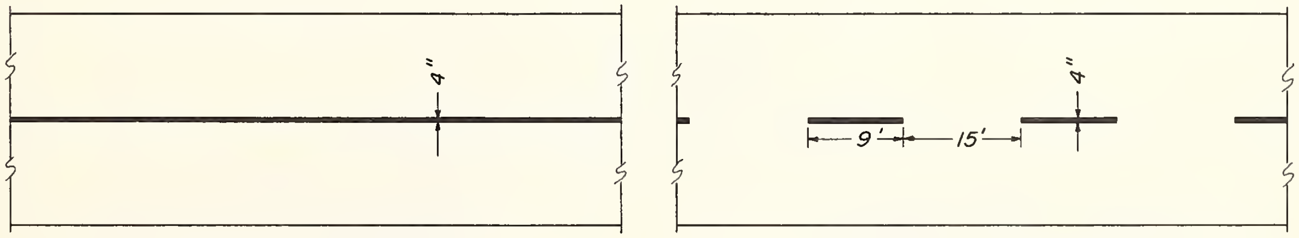


TWO-LANE RURAL



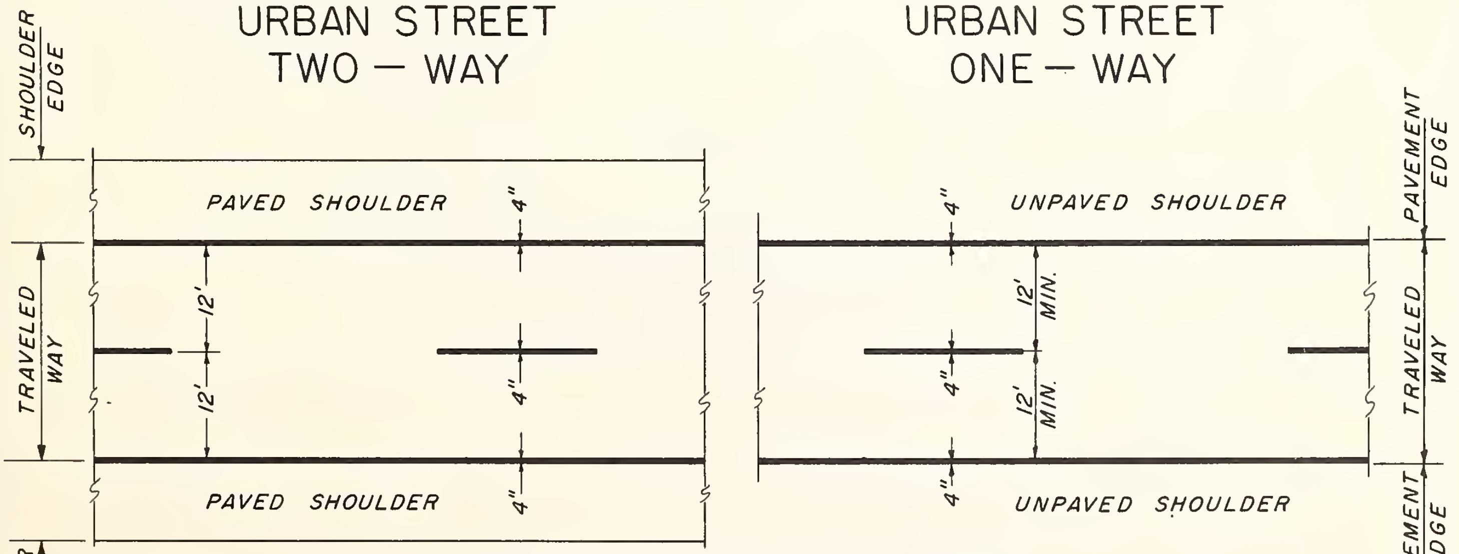
FOUR-LANE UNDIVIDED RURAL

FOUR-LANE UNDIVIDED URBAN



URBAN STREET TWO-WAY

URBAN STREET ONE-WAY



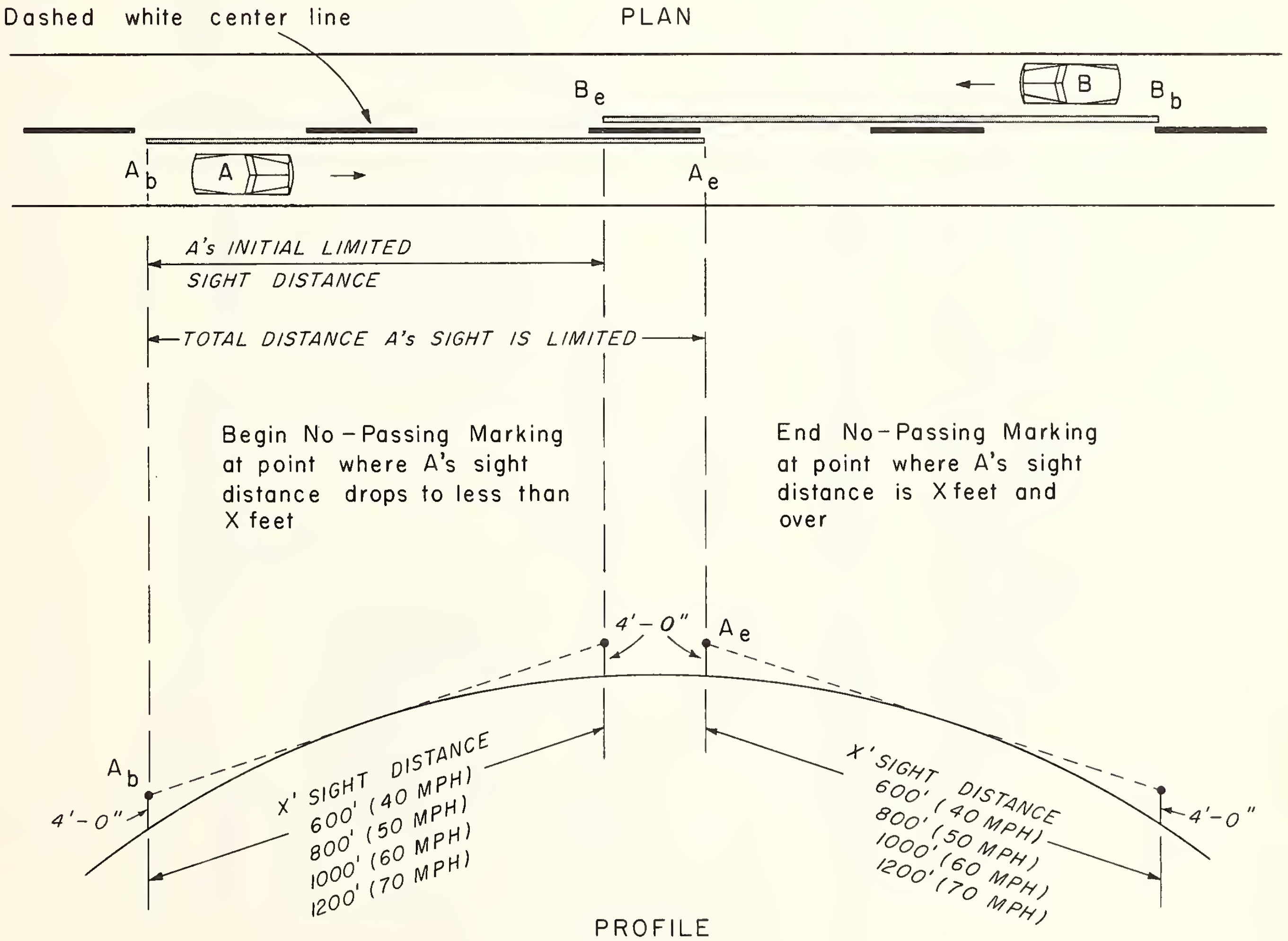
PAVEMENT EDGE LINES

FIGURE 2

STANDARD PAVEMENT MARKINGS

VERTICAL CURVE – TWO LANE PAVEMENT

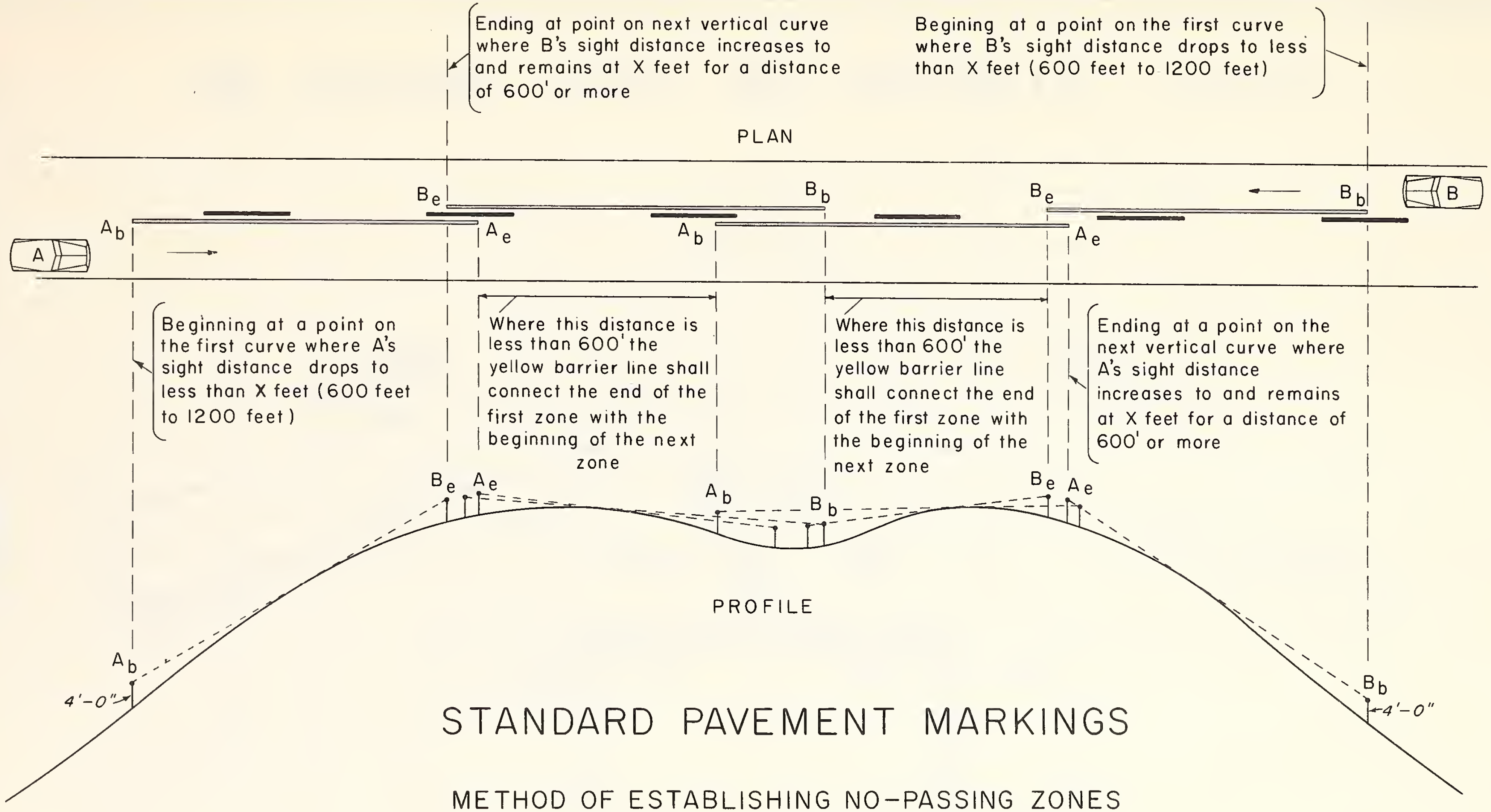
WHERE SIGHT DISTANCE IS LESS THAN "X" FEET


Dashed white center line
PLAN
B e
B
B b
A
A b
A e
A's INITIAL LIMITED SIGHT DISTANCE
TOTAL DISTANCE A's SIGHT IS LIMITED
Begin No – Passing Marking at point where A's sight distance drops to less than X feet
End No – Passing Marking at point where A's sight distance is X feet and over
4'– 0"
A e
A b
4'– 0"
X' SIGHT DISTANCE
600' (40 MPH)
800' (50 MPH)
1000' (60 MPH)
1200' (70 MPH)
X' SIGHT DISTANCE
600' (40 MPH)
800' (50 MPH)
1000' (60 MPH)
1200' (70 MPH)
4'– 0"
PROFILE

Note: The method of establishing the no-passing markings, as shown on the profile, is for A's direction only. The method for B's direction is similar

FIGURE 3

FIGURE 4


Ending at point on next vertical curve where B's sight distance increases to and remains at X feet for a distance of 600' or more
Begining at a point on the first curve where B's sight distance drops to less than X feet (600 feet to 1200 feet)
PLAN
A
B
B_e
B_b
B_e
B_b
A_b
A_e
A_b
A_e
Beginning at a point on the first curve where A's sight distance drops to less than X feet (600 feet to 1200 feet)
Where this distance is less than 600' the yellow barrier line shall connect the end of the first zone with the beginning of the next zone
Where this distance is less than 600' the yellow barrier line shall connect the end of the first zone with the beginning of the next zone
Ending at a point on the next vertical curve where A's sight distance increases to and remains at X feet for a distance of 600' or more
B_e
A_e
A_b
B_b
B_e
A_e
PROFILE
A_b
4'-0"
B_b
4'-0"

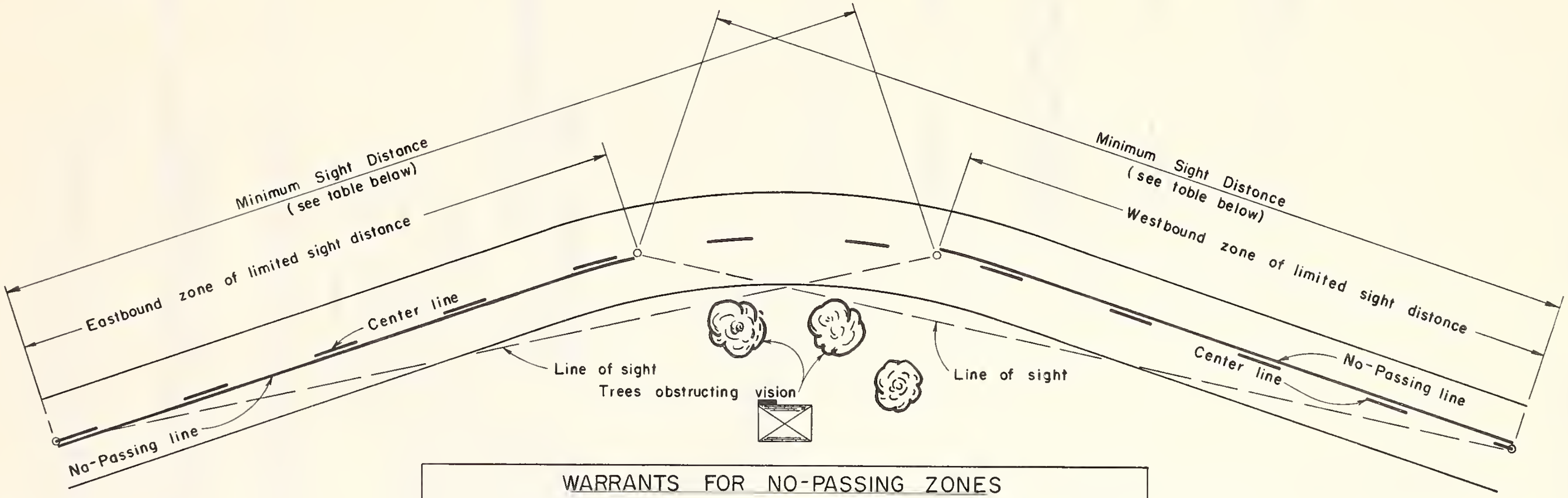
STANDARD PAVEMENT MARKINGS

METHOD OF ESTABLISHING NO-PASSING ZONES FOR SUCCESSIVE VERTICAL CURVES*

ON TWO-LANE PAVEMENTS

* Successive horizontal curves on two-lane pavements shall be marked similarly

NO - PASSING LINES ON HORIZONTAL CURVES



WARRANTS FOR NO-PASSING ZONES

85 PERCENTILE SPEED (mile per hour)	MINIMUM SIGHT DISTANCE (feet)
30	500
40	600
50	800
60	1000
70	1200

NOTES

① Begin the No-Passing line when the measured line of sight becomes less than the minimum sight distance

② End the No-Passing line when the measured line of sight again exceeds the minimum sight distance.

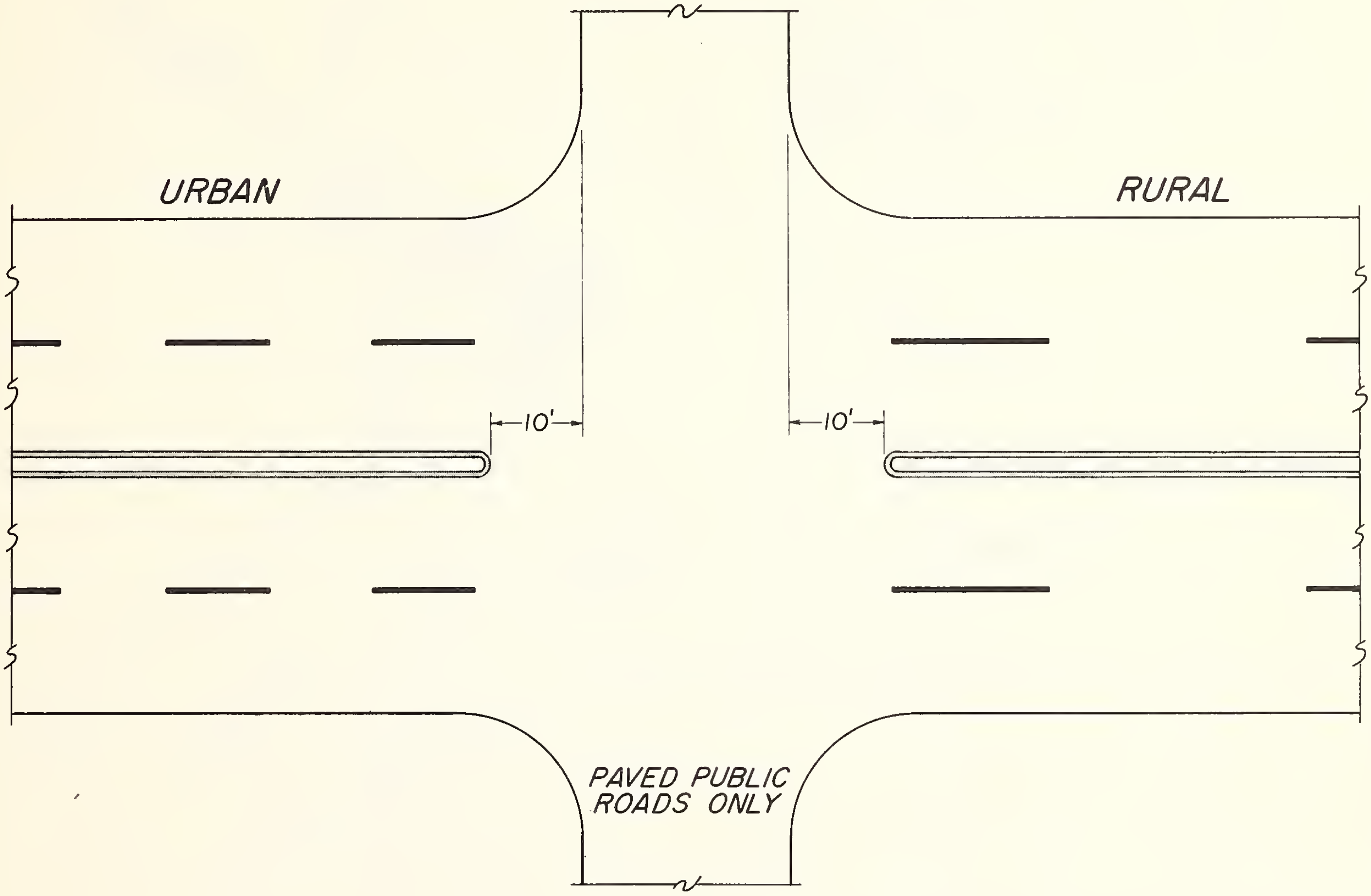
③ Consult Table for the minimum sight distance determined by the 85th. percentile speed.

④ The No-Passing lines may or may not overlap depending on the alinement.

FIGURE 5

INTERSECTION STRIPING

FOUR LANE UNDIVIDED HIGHWAY



NO PASSING ZONES FOR APPROACHES TO NARROW BRIDGES

Striping on structures ***less*** *than 24' in width, curb to curb, with no other restrictions on sight distance*

300' in urban areas.
500' in rural areas.

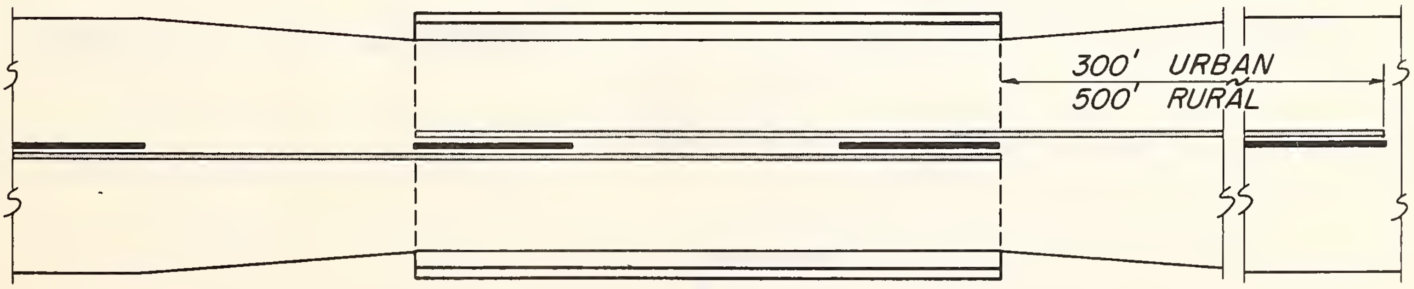
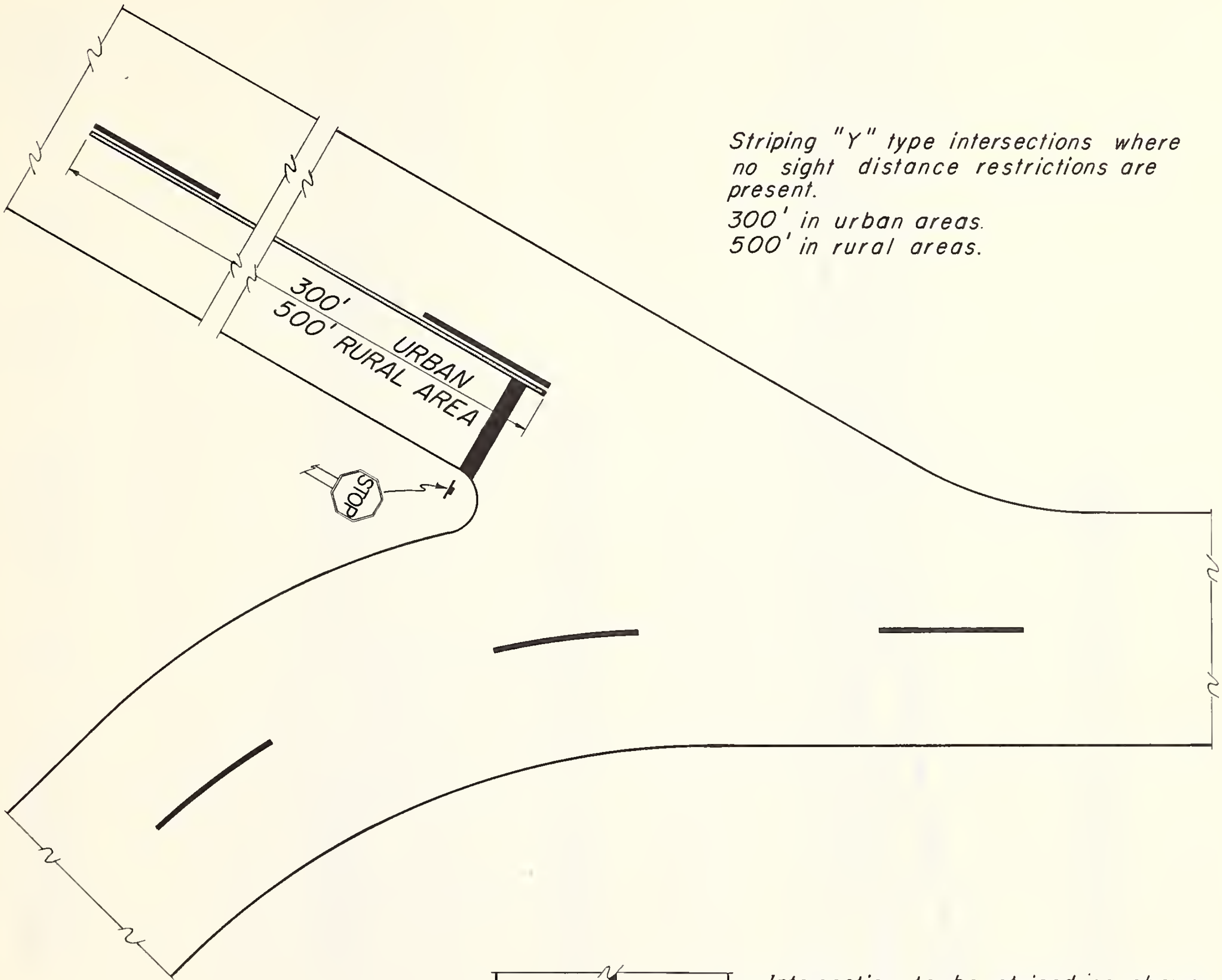


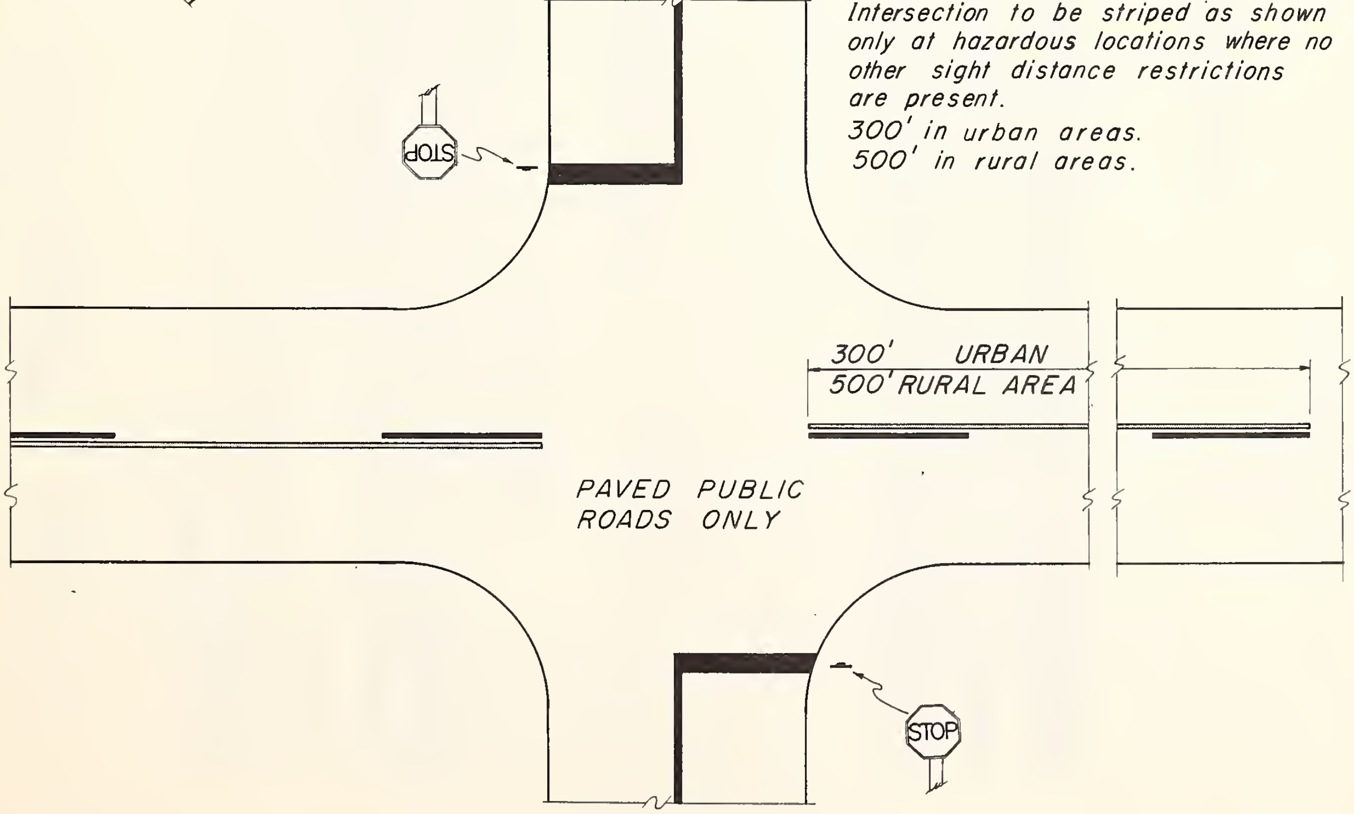
FIGURE 6

NO PASSING ZONES AT INTERSECTIONS



Striping "Y" type intersections where no sight distance restrictions are present.

300' in urban areas.
500' in rural areas.

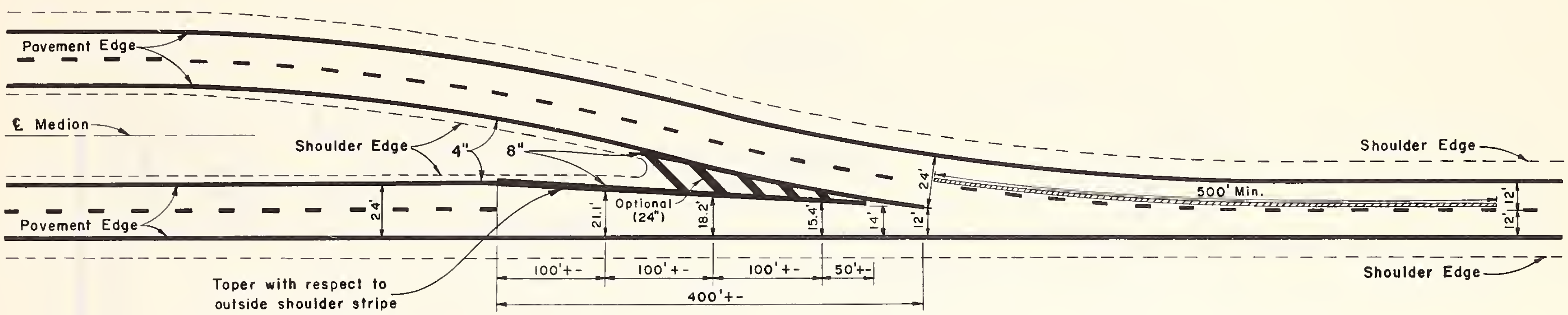


Intersection to be striped as shown only at hazardous locations where no other sight distance restrictions are present.

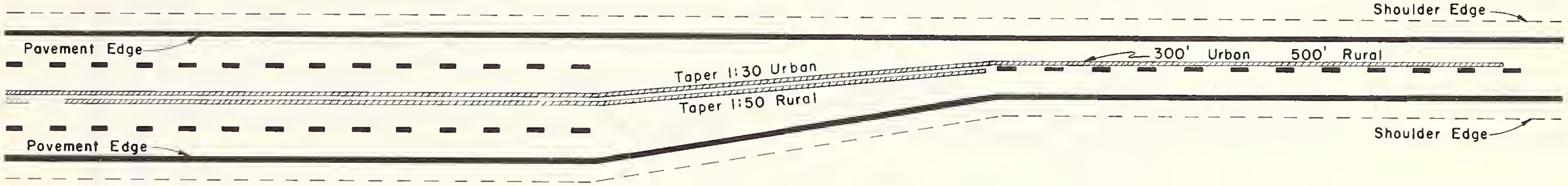
300' in urban areas.
500' in rural areas.

FIGURE 6A

TYPICAL TRANSITION MARKING 2 LANE TO 4 LANE



TYPICAL TRANSITION MARKING – 2 LANE TO 4 LANES DIVIDED



TYPICAL TRANSITION MARKING – 2 LANE TO 4 LANES

FIGURE 7

TYPICAL LANE - USE - CONTROL MARKINGS

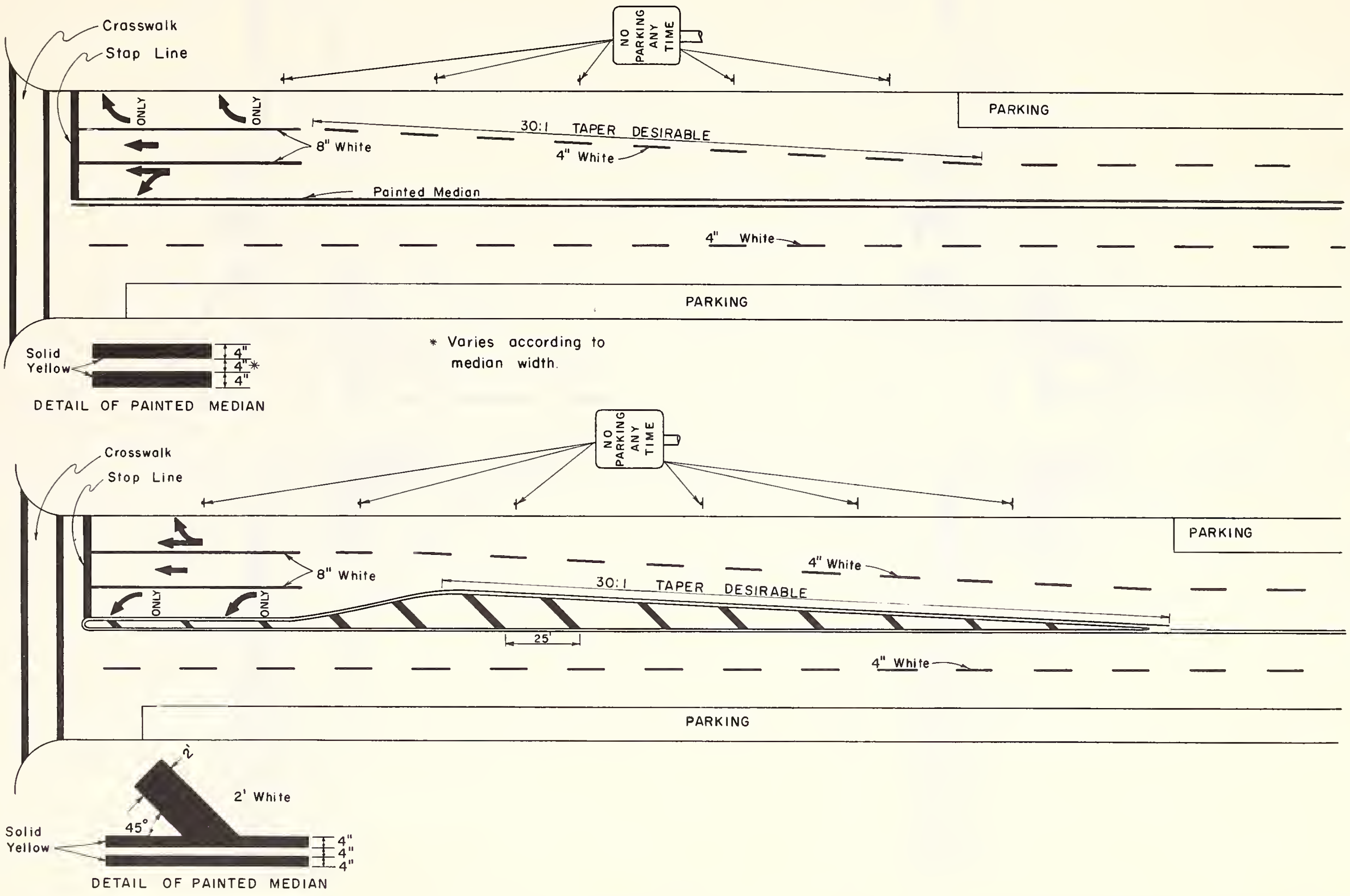


FIGURE 8

CHANNELIZATION MARKINGS

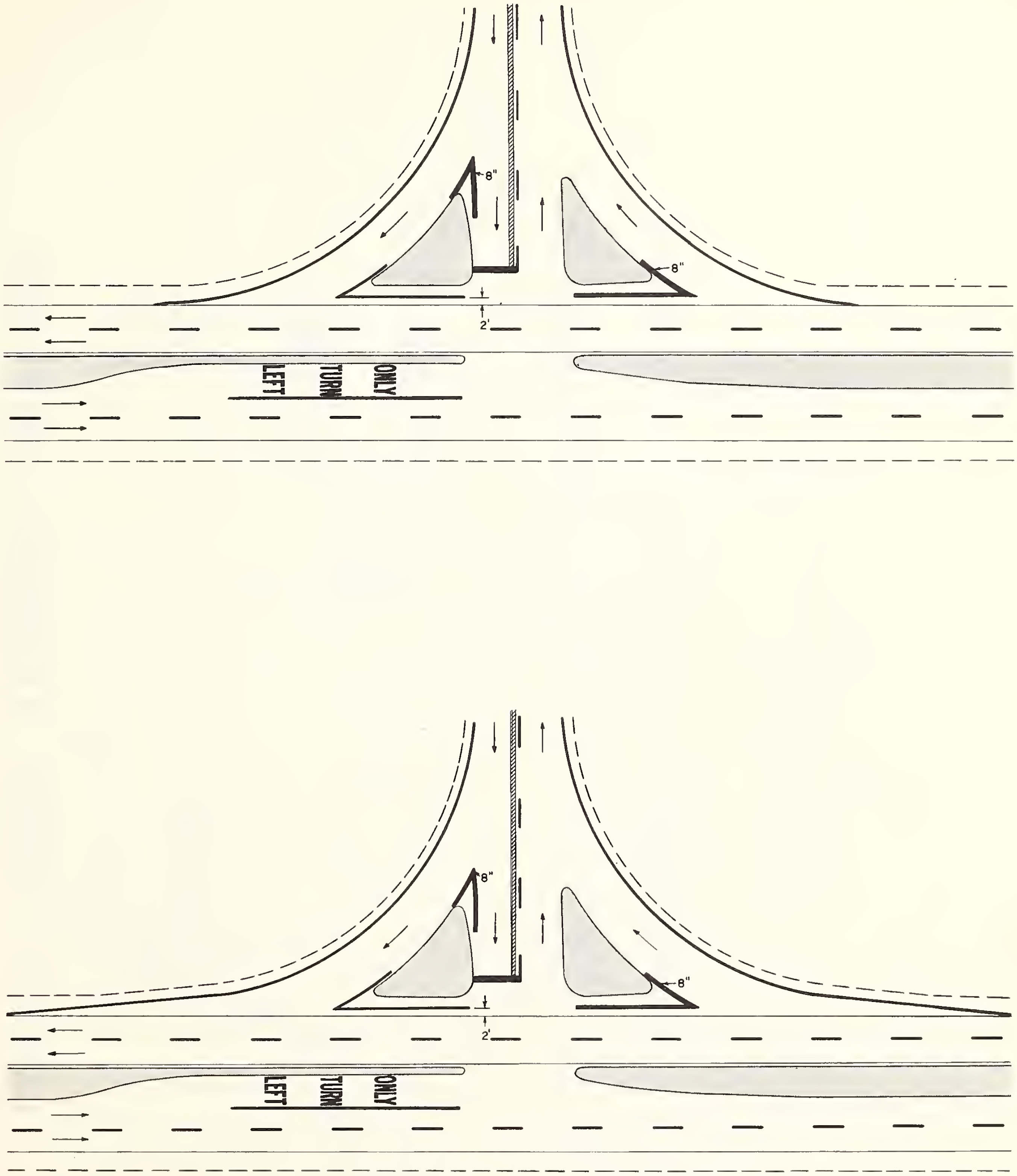
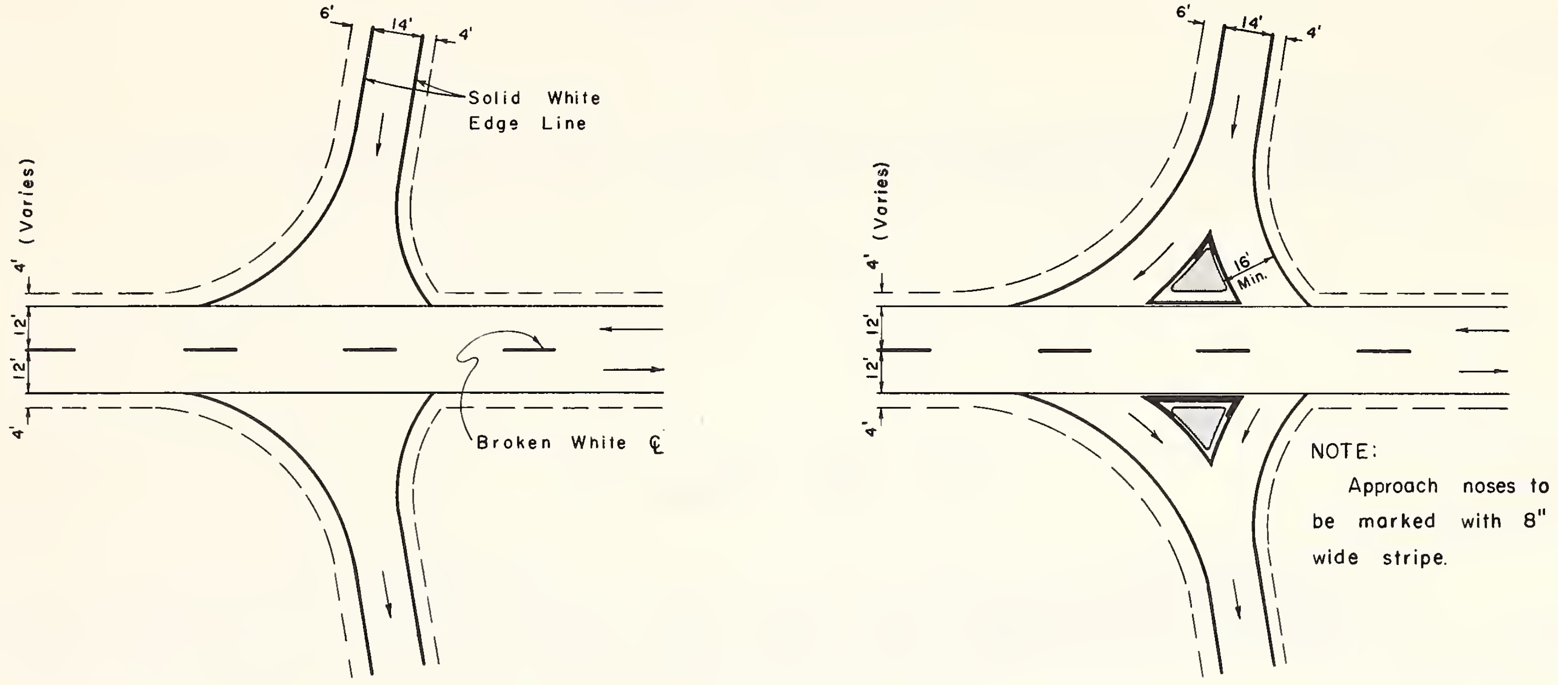


FIGURE 9

TYPICAL RAMP TERMINAL MARKINGS



UN-CHANNELIZED

CHANNELIZED

NOTE:
Approach noses to be marked with 8" wide stripe.

FIGURE 10

TYPICAL ACCEL & DECEL LANE MARKINGS

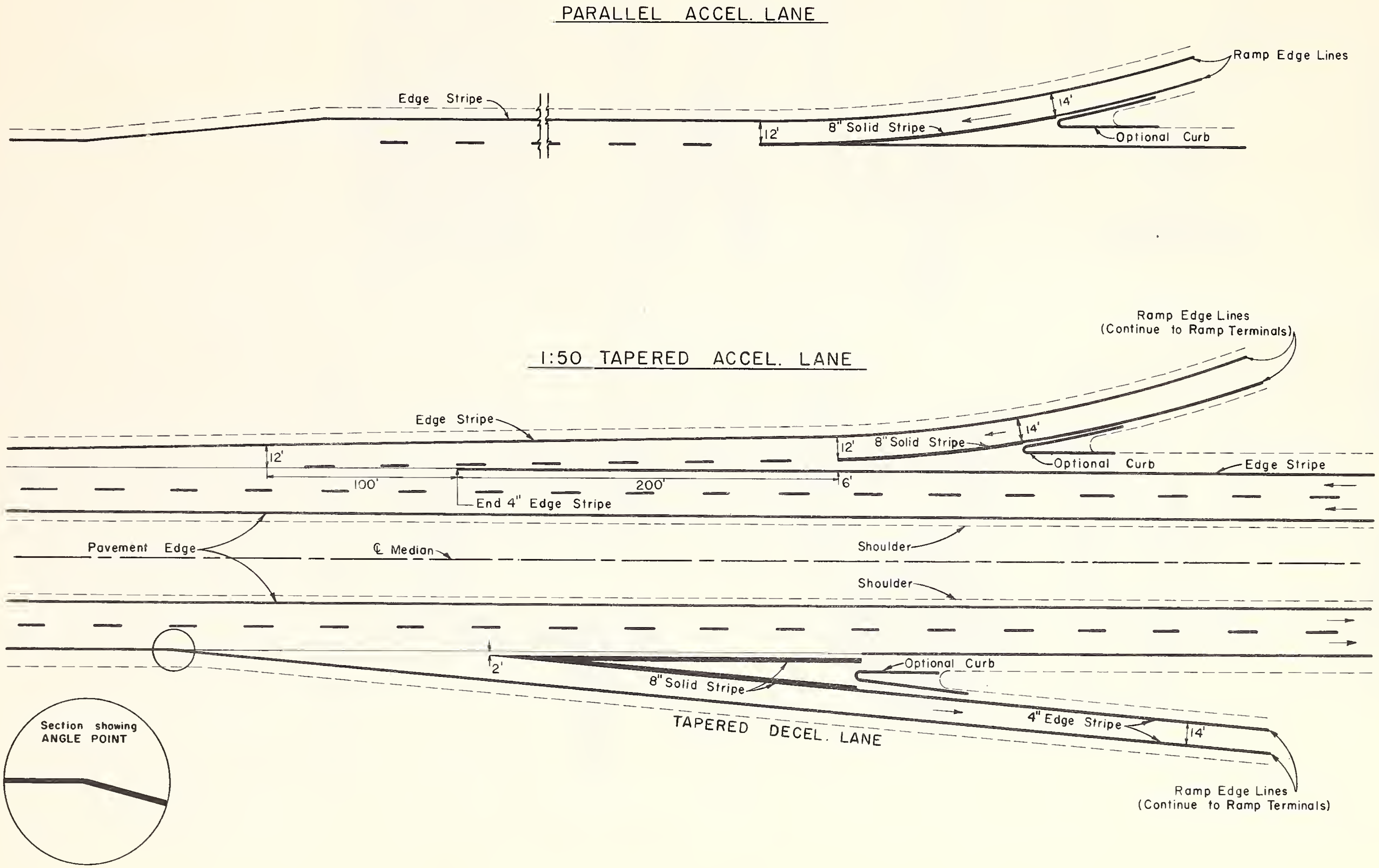
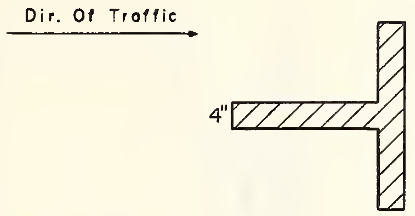
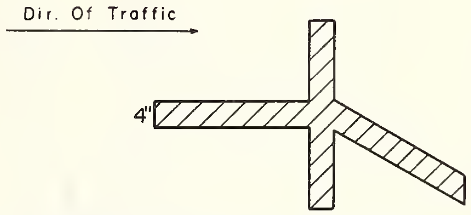


FIGURE 11

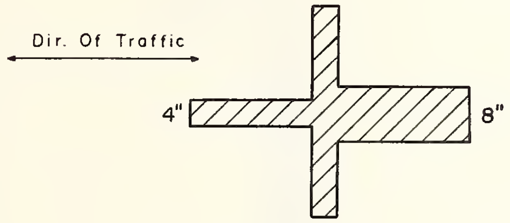
STRIPING LAYOUT SYMBOLS



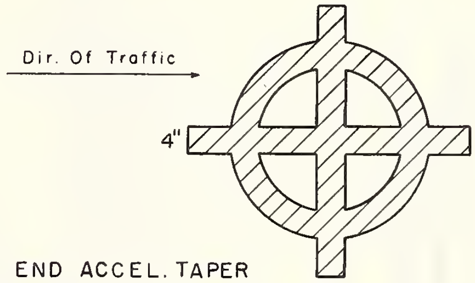
① END OF LINE



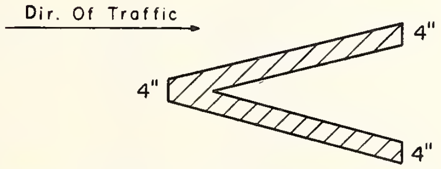
② END LINE - BEG. NEW LINE AT ANGLE



③ END 4" LINE - BEG. 8" LINE



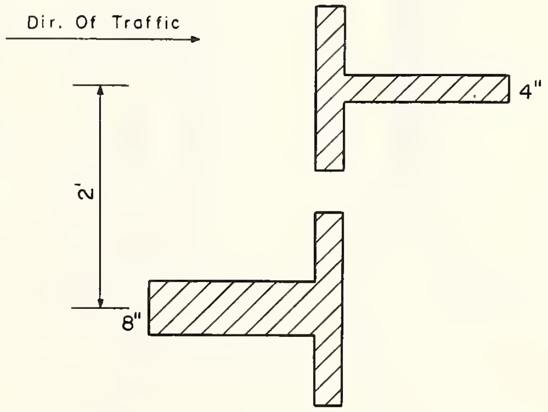
④ END ACCEL. TAPER



⑤ BEG 8" GORE MARKING ON DECEL. LANE

NOTE:

These are standard layout symbols to be used in the typical locations shown on the following page. They also have application on other pavement marking projects. Consistent and proper use of these symbols will promote understanding and eliminate confusion between layout crews, pavement marking crews and others concerned with pavement markings.



⑥ END 8" LINE - BEG. 4" LINE (2' OFFSET)

FIGURE 12

TYPICAL USE OF STRIPING LAYOUT SYMBOLS

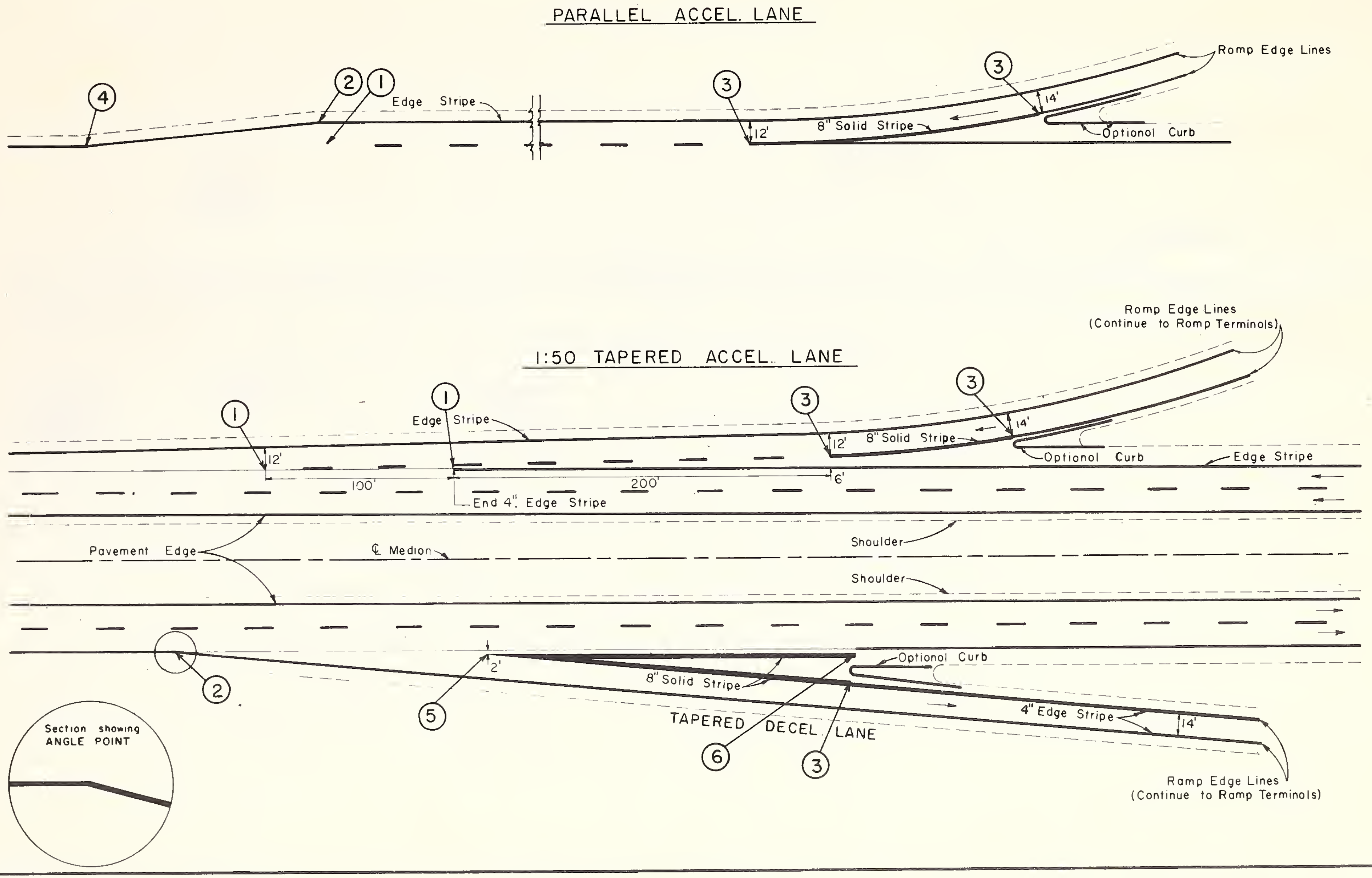


FIGURE 13

STANDARD PAVEMENT MARKINGS FOR TRUCK CLIMBING LANES

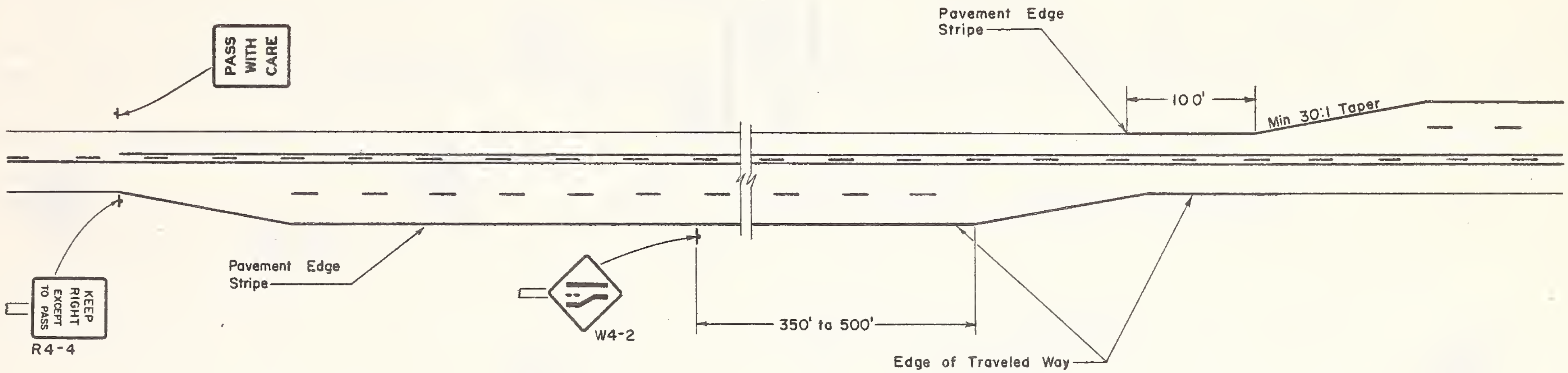
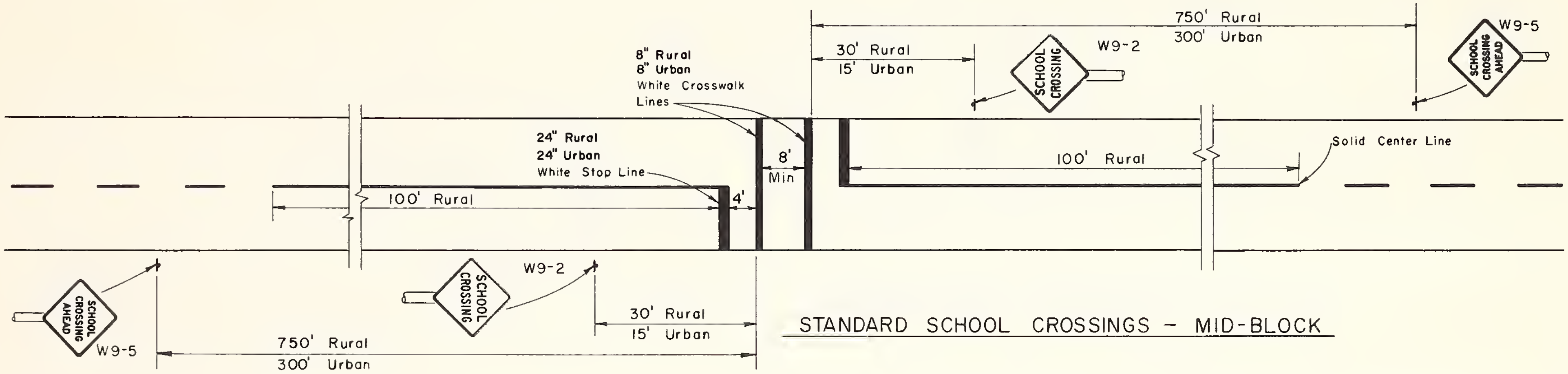
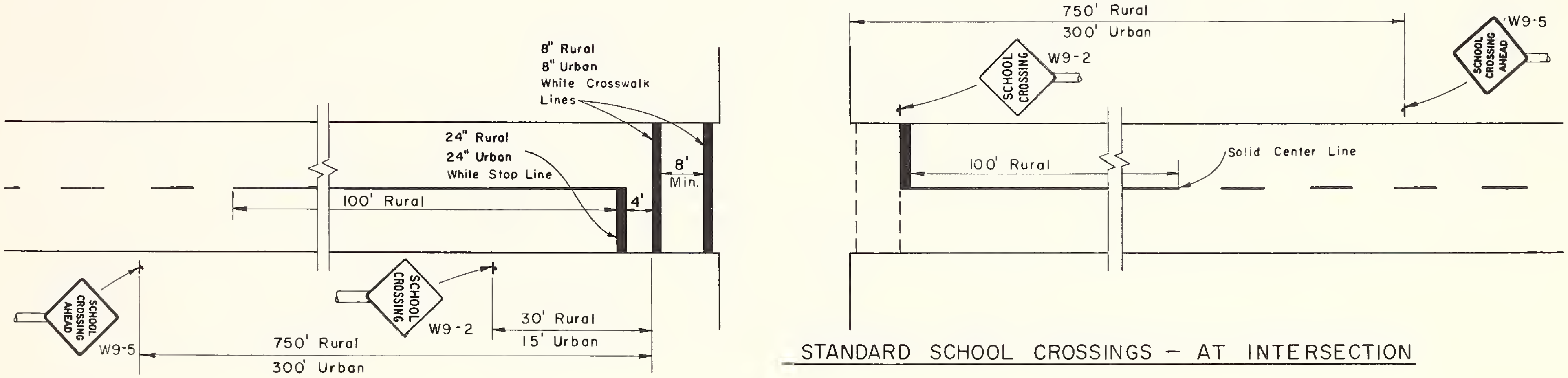


FIGURE 14

SCHOOL CROSSING (UNPATROLLED)



STANDARD SCHOOL CROSSINGS – MID-BLOCK

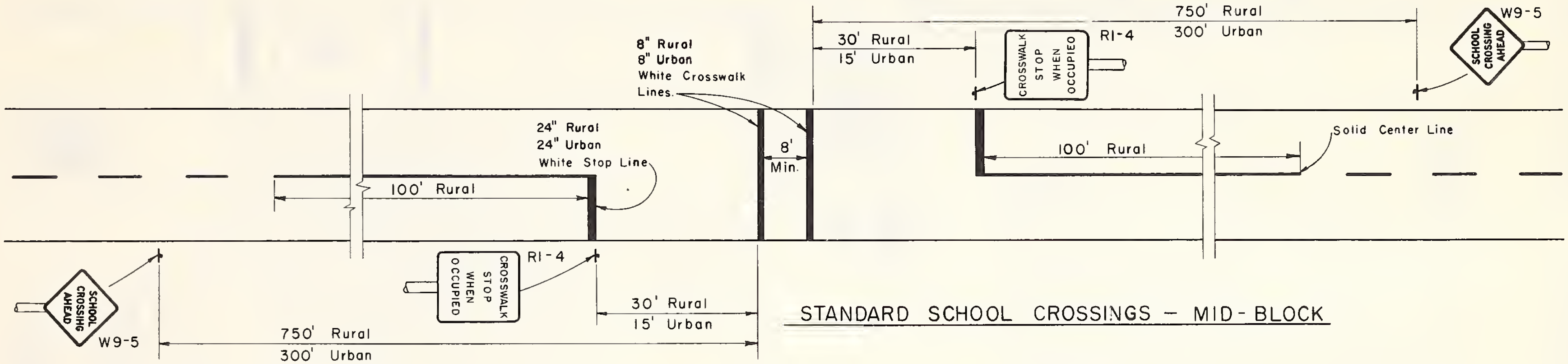


STANDARD SCHOOL CROSSINGS – AT INTERSECTION

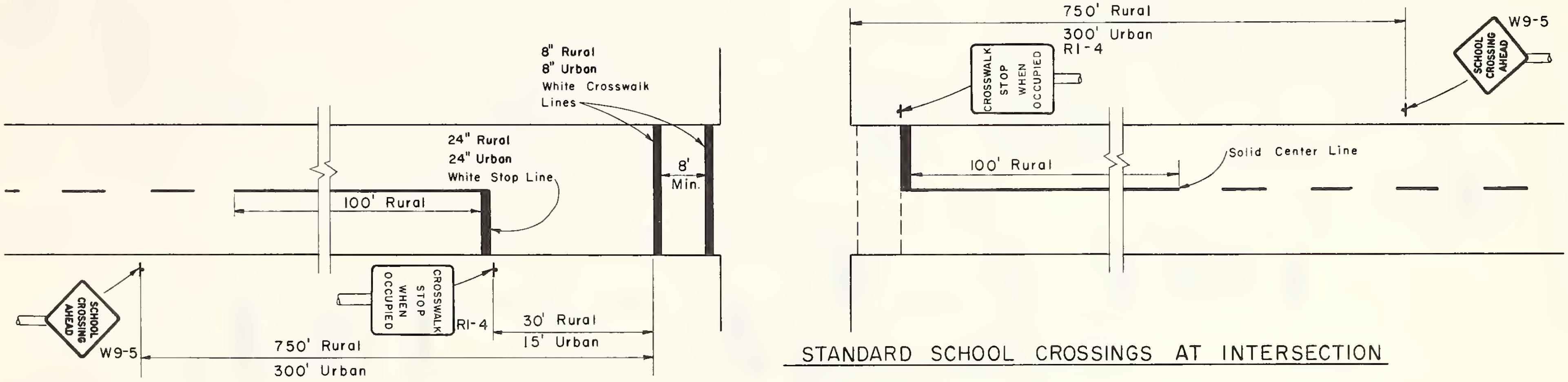
FIGURE 15

SCHOOL CROSSING (PATROLLED)

When School Crossing is Patrolled by a School Patrol, Police, or Adult Crossing Guards.



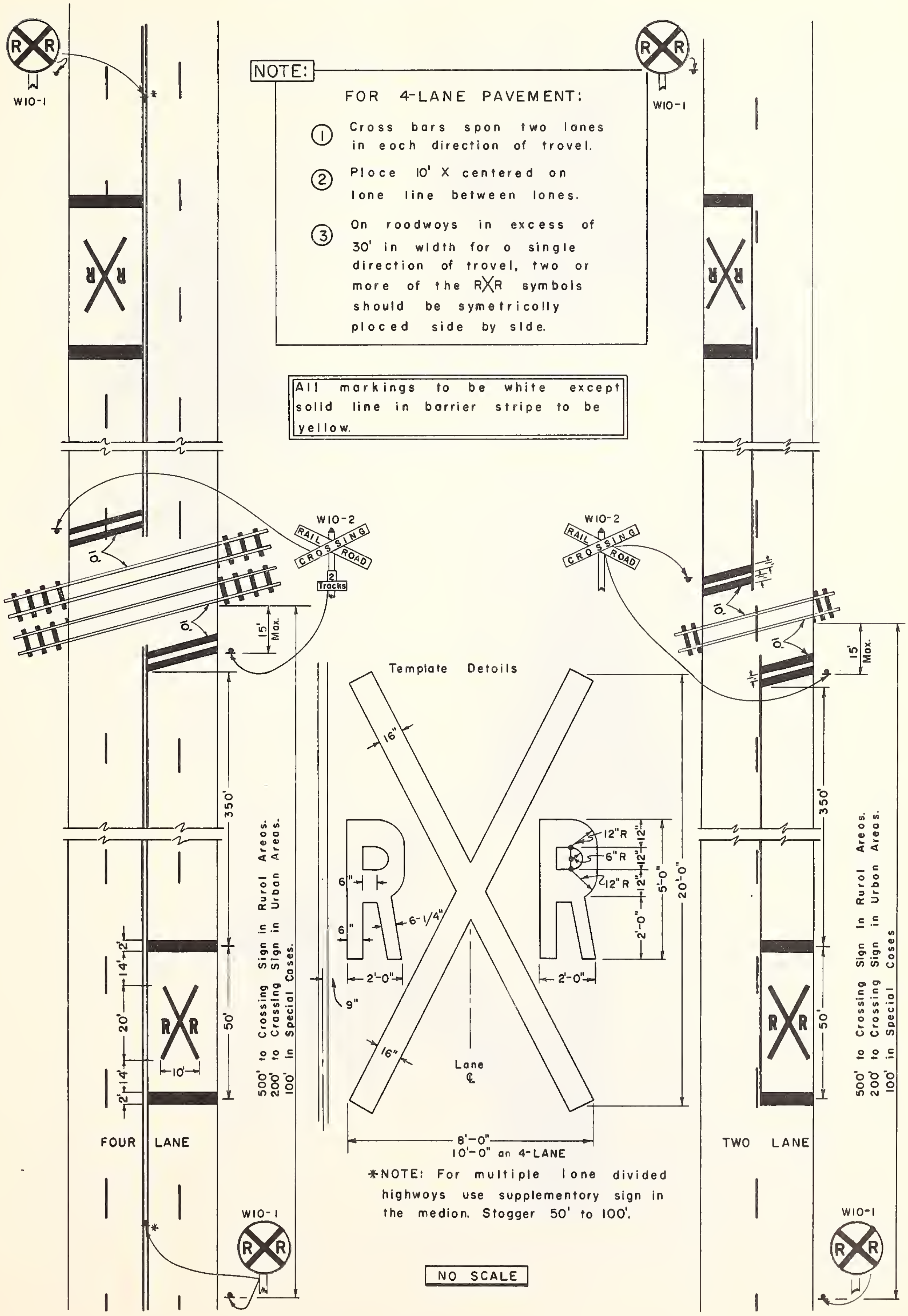
STANDARD SCHOOL CROSSINGS – MID-BLOCK



STANDARD SCHOOL CROSSINGS AT INTERSECTION

FIGURE 16

RAILROAD GRADE CROSSINGS



NOTE:

FOR 4-LANE PAVEMENT:

① Cross bars span two lanes in each direction of travel.

② Place 10' X centered on lane line between lanes.

③ On roadways in excess of 30' in width for a single direction of travel, two or more of the R╳R symbols should be symetrically placed side by side.

All markings to be white except solid line in barrier stripe to be yellow.

500' to Crossing Sign in Rural Areas.
200' to Crossing Sign in Urban Areas.
100' in Special Cases.

*NOTE: For multiple lane divided highways use supplementary sign in the median. Stagger 50' to 100'.

FIGURE 17

ELONGATED ARROWS

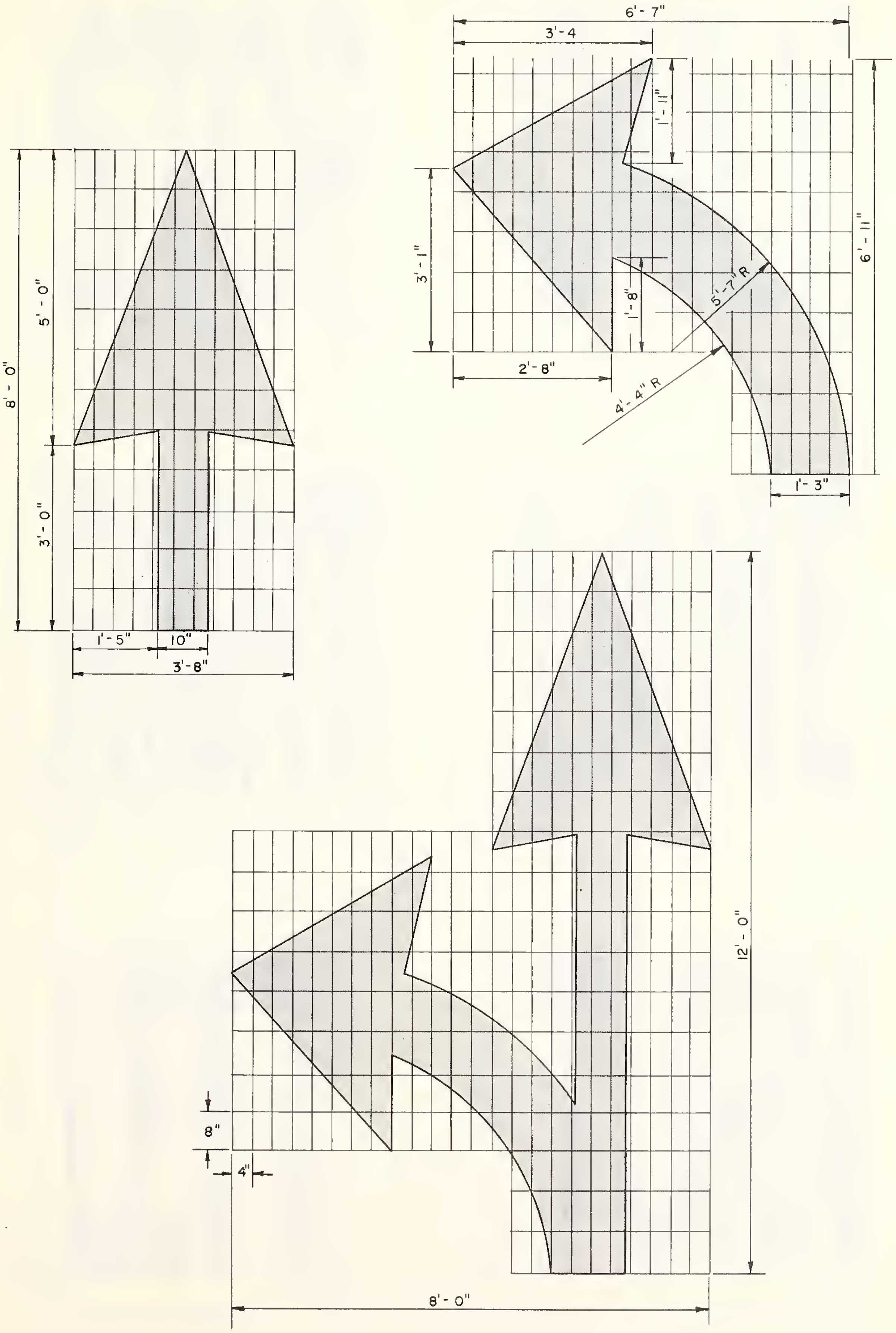


FIGURE 18

ELONGATED LETTERS

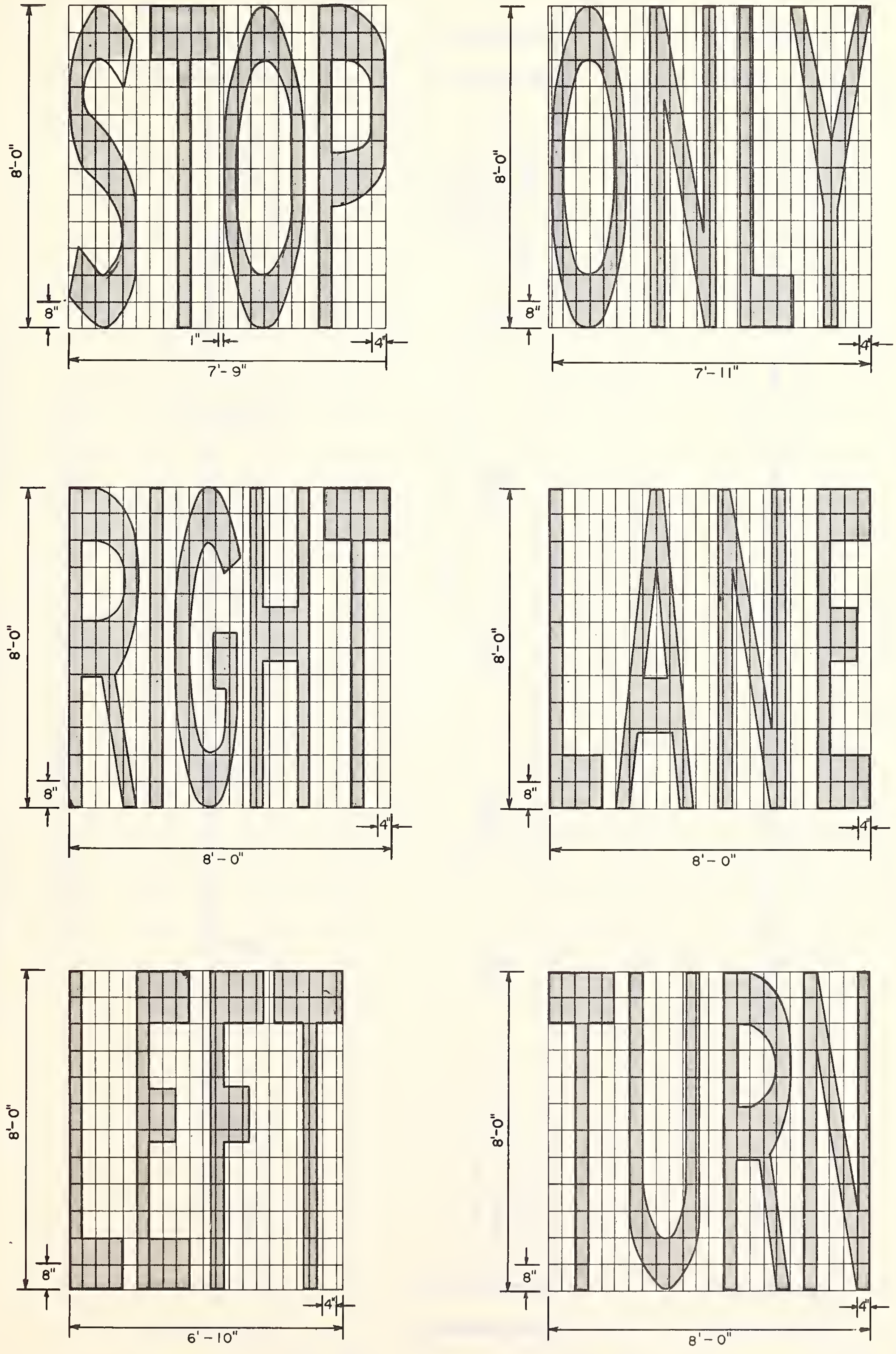


FIGURE 19

STANDARD PAVEMENT MARKINGS

PARKING SPACE-LIMITS & STALLS

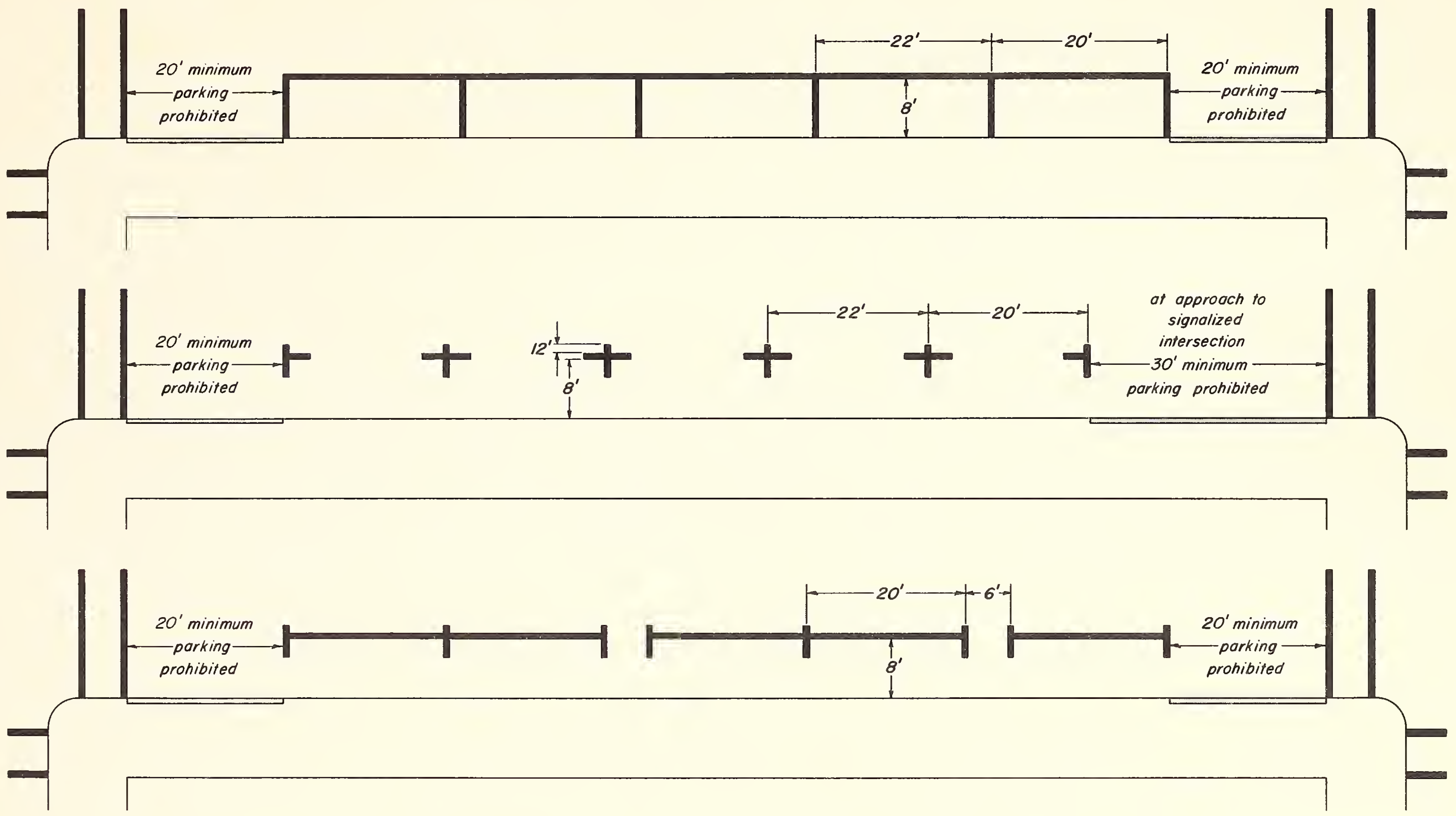

20' minimum parking prohibited
22'
20'
8'
20' minimum parking prohibited
20' minimum parking prohibited
12'
8'
22'
20'
at approach to signalized intersection 30' minimum parking prohibited
20' minimum parking prohibited
20'
6'
8'
20' minimum parking prohibited

FIGURE 20